Cancelled now AP 113E-0426-16 AL/142



Do not destroy.

# Appendix 1

# PUMP, WATER/METHANOL, TYPES SPM 7 MK. 1 AND 2, AND SPM 7/RS MK. 1 AND 2

## LIST OF CONTENTS



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## LIST OF ILLUSTRATIONS

### Introduction

**1.** This appendix details physical differences and variations in the reconditioning procedure for SPM.7/RS Mk. 1 and 2 and SPM.7 Mk. 1 and 2 water/methanol pumps as compared with those given for SPM.7/RS Mk. 3 and SPM.7 Mk. 3 pumps in the basic chapter. Unless otherwise stated all procedure details in this appendix apply to both the SPM.7/RS and SPM.7 pumps.

**2.** Whenever possible a Mk. 1 pump should be rebuilt to at least the Mk. 2 standard and preferably to Mk. 3 standard as detailed in the basic chapter. Rebuilding to Mk. 3 standard, however, necessitates the fitting of a different type of main seal and should not be attempted unless all new and modified components have been obtained from Stores.

## RECONDITIONING

### Tools and test equipment

**3.** In addition to the standard bench tools, the special tools listed in Table 1 are required to overhaul the SPM.7/RS Mk. 1 and 2 and SPM.7 Mk. 1 and 2 pumps. Details of a suitable test rig are included in para. 39 of the basic chapter.

## DISMANTLING

**Note . . .**

*Where no details are given in the following procedure, refer to the similar operation in the basic chapter.*

### Removing the pump filter

**4.** Remove the filter bonding bracket screw (42)—Mk. 2 only—together with the filter securing nuts (1). Withdraw the filter and distance pieces (5). Remove any seals exposed.

### Separating the upper and lower bases

**5.** (1) Remove the four screws securing the electrical connection (21) and dismantle the connection, leaving the pins attached to the motor supply leads.

(2) Remove the eight nuts (41) securing the upper and lower bases, releasing the bonding bracket (42—Mk. 2 only). Tap the lower base (17) free of the upper base with a hide faced hammer and discard the washer (22).

(3) On some Mk. 2 units only, disconnect the bonding strip (75) from the lower base by removing the cheese-head screw (18) and shakeproof washer (19).

**TABLE 1**

**Special tools and equipment**

| Nomenclature | Part Number | Fig. No. (Basic Chapter) |
|---|---|---|
| Vapour assister extractor | SPE 11536 | 4 |
| Thrower ring spanner | SPE 8214 | |
| Calibrated fan (motor speed setting) | SPE 16500 | |
| Guide, Drift — Removal of bellows gland assembly | SPE 8181, SPE 8216 | App. 1 Fig. 3 |
| Bearing sleeve pad, Collar, Centring adapter — De-sleeving and re-sleeving upper bearing | SPE 8186, SPE 8255, SPE 8184 | 5 |
| Base—miscellaneous uses | SPE 8218 | |
| Guide pin, Guide bush — Replacement of bellows gland | SPE 8219, SPE 11535 | App. 1 Fig. 4, App. 1 Fig. 4 |
| Supporting plate assembly | SPE 8215 | App. 1 Fig. 5 |
| Spigot and clock assembly — Checking loading of bellows gland | SPE 11543 | App. 1 Fig. 5 |
| Weight | SPE 11537/MOD | App. 1 Fig. 5 |
| Pressure test blanking plate, Gasket — Gland seal pressure test | SPE 17626, SPE 17627 | 9 |
| Test rig | | 10 |

**Dismantling the lower base**

**6.** (1) Press out the blanking plate (24—Mk. 2 only) or non-return valve (84—Mk. 1 only) and remove the drain plug (14) and washer (15).

(2) Release the fireproof cover (16) by removing the six screws (13) and spring washers (12).

(3) Remove the studs (26) from the lower base only if damaged.

**Removing the impeller and vapour assister**

**7.** (1) Remove the self-locking impeller nut (23) using a spanner on the flats of the armature to prevent rotation.

(2) Withdraw the impeller (25) together with the adjusting bush (83) and any shims (27) fitted. Suitably label these shims with reference to their location to facilitate reassembly.

(3) Use the extractor tool SPE.11536 illustrated in fig. 4 in the basic chapter, to withdraw the vapour assister assembly (82). Remove the joint washers (81).

**Note . . .**

*Do not attempt to remove the carbon insert from the vapour assister assembly.*

**Separating the motor unit from the upper base**

**8.** (1) Remove the self-locking nuts (6: 40) from the long and short bolts (36 and 4 respectively). Withdraw the clamping bolt ring (7) and withdraw the outer motor casing ((9)—SPM.7/RS: (9A)—SPM.7) together with the joint ring (8).

**Note . . .**

*The motor unit is now free in the upper base.*

(2) Withdraw the motor unit from the upper base (85) taking care not to damage the armature spindle or the convolutions of the flexible bellows gland.

(3) Complete the dismantling of the upper base by removing the bellows gland (80) if its sealing face is scored or if there is evidence of leakage past the unit. To remove the gland, pre-heat the casting to approximately 200 deg. F. (92 deg. C.) and use the tools illustrated in fig. 3 to press the gland out of the casting.

**Motor unit**

**9.** Refer to the basic chapter, para. 10-13.

**Key to Fig. 1**

1 SELF-LOCKING NUT
2 FILTER ASSEMBLY (MK. 2 PUMPS ONLY)
2A FILTER ASSEMBLY (MK. 1 PUMPS ONLY
3 C/SK. HD. SCREW (MK. 2 PUMPS ONLY)
4 SHORT BOLT
5 DISTANCE TUBE (FILTER SUPPORT)
6 SELF-LOCKING NUT
7 CLAMPING RING
8 JOINT RING
9 OUTER MOTOR CASING (SPM 7/RS ONLY)
9A OUTER MOTOR CASING (SPM 7 ONLY)
12 SPRING WASHER
13 CH. HD. SCREW
14 DRAIN PLUG
15 BONDED SEAL WASHER
16 FIREPROOF COVER ASSEMBLY
17 LOWER BASE
21 ELECTRICAL CONNECTION
22 GASKET (UPPER/LOWER BASE)
23 SELF-LOCKING NUT
24 BLANKING PLATE (MK. 2 ONLY)
25 IMPELLER ASSEMBLY
26 STUD-LOWER BASE
27 SHIM (IMPELLER ADJUSTING)
36 LONG BOLT
40 SELF-LOCKING NUT
41 SELF-LOCKING NUT
42 FILTER BONDING BRACKET (MK. 2 ONLY)
43 SHAKEPROOF WASHER (MK. 2 ONLY)
80 BELLOWS GLAND ASSEMBLY
81 SHIM (VAPOUR ASSISTER)
82 VAPOUR ASSISTER ASSEMBLY
83 SPACING BUSH
84 NON-RETURN VALVE (MK. 1 ONLY)
85 UPPER BASE

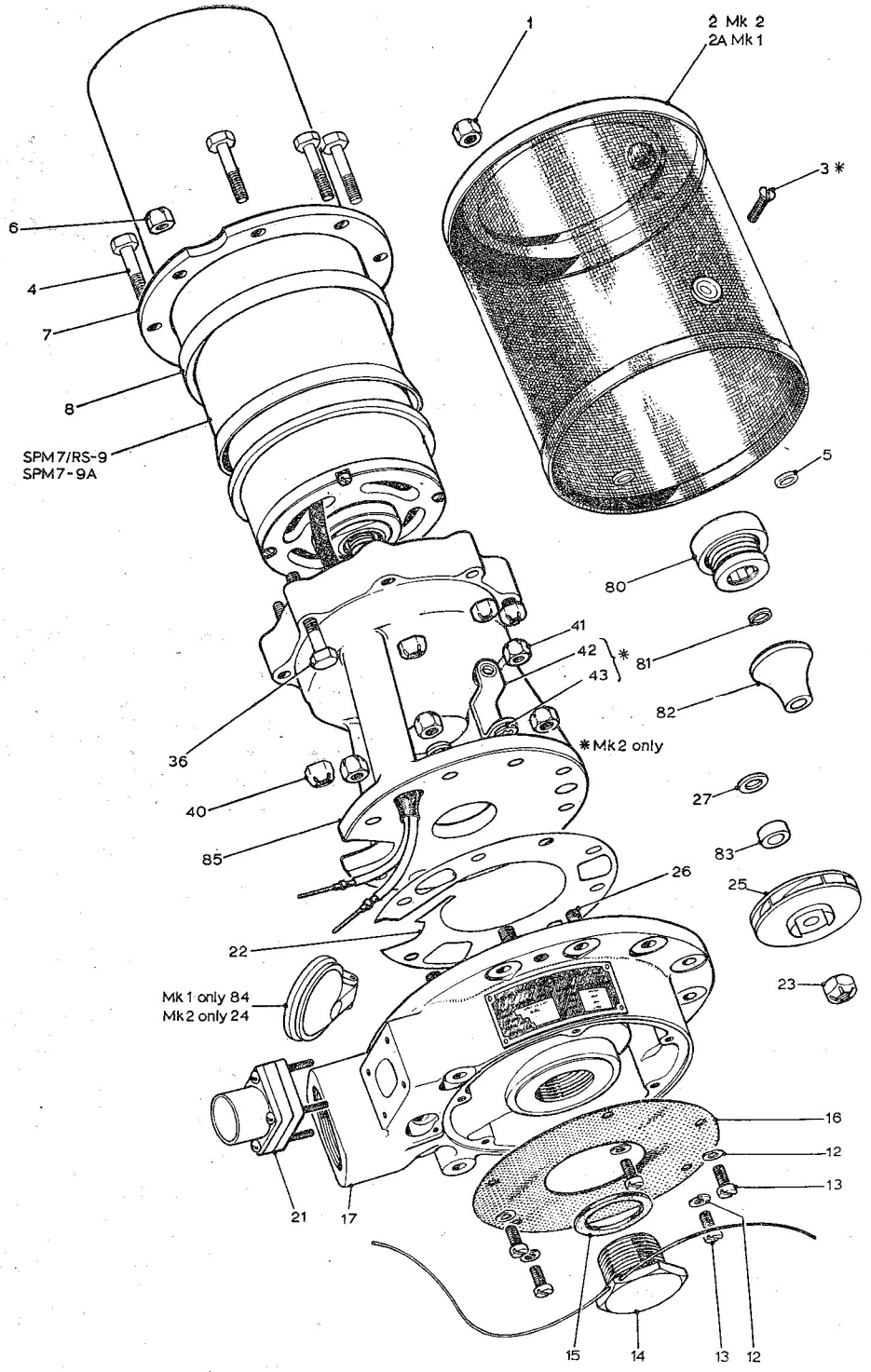


**Fig. 1. Exploded view of pump unit**

## CLEANING, EXAMINATION AND REPAIR

**10.** All details in the basic chapter are applicable to the SPM.7/RS Mk. 1 and 2 and SPM.7 Mk. 1 and 2 pumps with the following exceptions and additions:—

(1) Cleaning: No parts of Mk. 1 pumps are treated with the blue varnish.

(2) Table 2—basic chapter: Ignore the following items—(a) Seal assembly; (b) Seal spring: and for Mk. 1 pumps only, the examination of the blue varnish film. Add inspections as detailed in Table 2.

(3) Basic chapter: Ignore the following item:—
Clearance—upper and lower seal carriers.
Include checks detailed in Table 3.

## ASSEMBLING

### Motor unit

**11.** The following operations are the same as for the basic chapter:—

(1) Assembling the lower bearings

(2) Assembling the upper bearings

(3) Fitting the brush box assembly

(4) Assembling the armature assembly

(5) Pre-bedding the brushes.

### Brush bedding and motor speed setting (SPM.7 Mk. 1 only)

**12.** (1) Re-assemble brushes into their original boxes. Secure with screws (48) and shakeproof washers (49), connecting a field coil lead to the first brush terminal of each pair.

## TABLE 2

**Detailed examination of components—additional items**

| Item | Examination | Action if faulty |
|---|---|---|
| Metallic bellows gland | Scoring of seal face | If slight, relap to a mirror finish. If excessive, renew bellows |
| | Damage to bellows convolutions | Renew unit |
| Vapour assister assembly | Scoring of carbon seal face and wear | If slight, relap to a mirror finish. If excessive (see Table 3), renew |

### Key to Fig. 2

**44** DUST SHIELD
**45** CH.HD. SCREW
**46** SPRING WASHER
**47** BRUSH BOX ASSEMBLY
**48** RD.HD. SCREW
**49** SHAKEPROOF WASHER
**50** BRUSH AND TAG ASSEMBLY
**51** CH.HD. SCREW (SPM 7/RS ONLY)
**52** SPRING WASHER (SPM 7/RS ONLY)
**53** CH.HD. SCREW (SPM 7/RS ONLY)
**54** SPRING WASHER (SPM 7/RS ONLY)
**55** CAPACITOR MOUNTING BRACKET (SPM 7/RS ONLY)
**56** CAPACITOR (SPM 7/RS ONLY)
**57** SELF-LOCKING NUT
**58** BRUSH BOX RETAINER
**59** BEARING COVER
**60** UPPER BEARING
**61** MOTOR CASING BUSH
**62** CH.HD. SCREW
**63** SPRING WASHER
**64** THROWER NUT
**65** FELT WASHER (THROWER NUT)
**68** MOTOR CASING BASE
**69** GREASE SHIELD
**70** LOWER BEARING
**71** BEARING RETAINING PLATE
**72** ARMATURE ASSEMBLY
**73** SPRING WASHER
**74** CH.HD. SCREW
**77** MOTOR CASING AND FIELD ASSEMBLY
**78** TAG (EARTHING LEAD-SPM 7/RS ONLY)
**79** ELECTRICAL LEAD ASSEMBLY (SPM 7/RS ONLY)

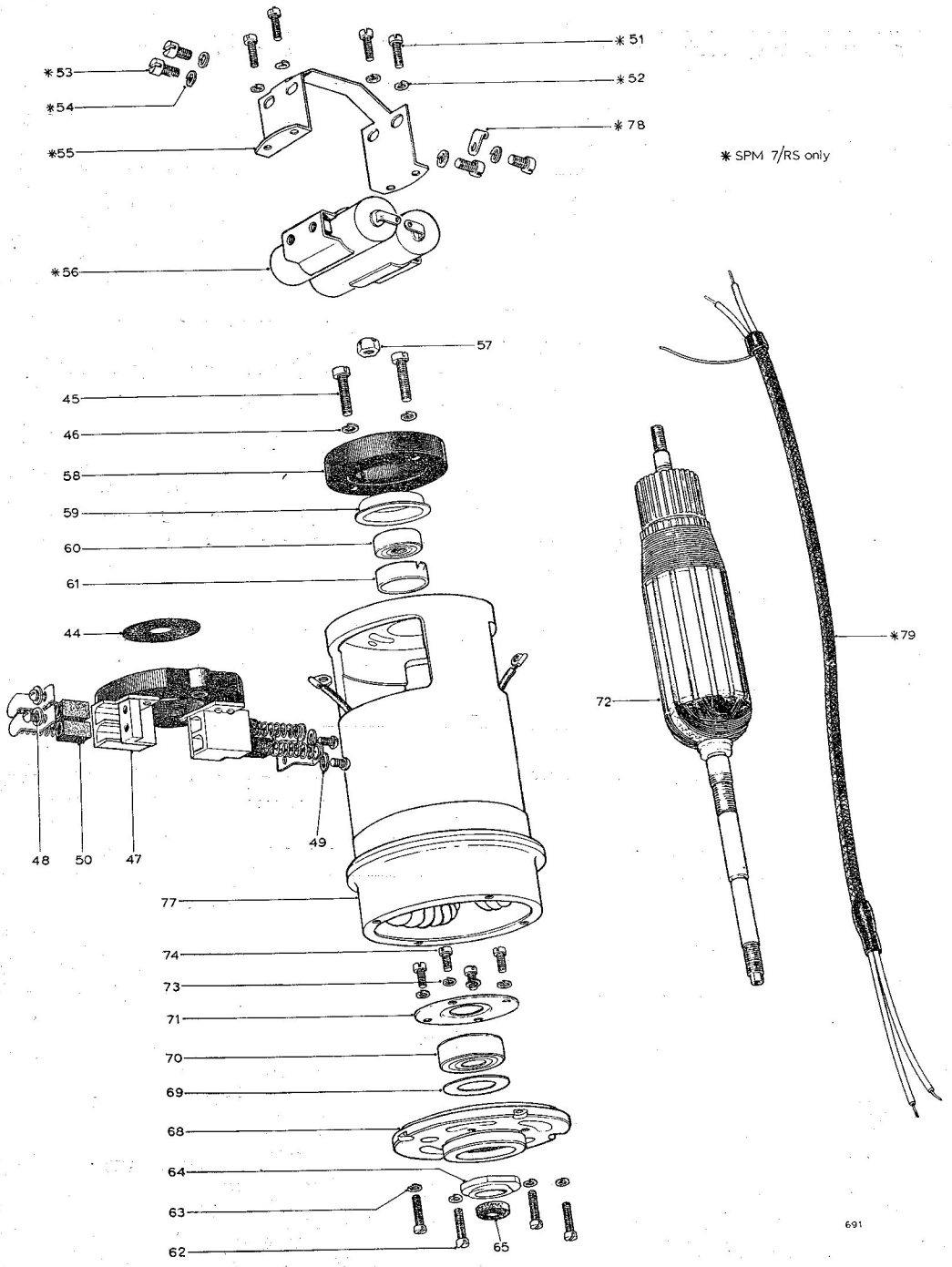


**Fig. 2. Exploded view of motor unit**

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RESTRICTED

## TABLE 3

**Fits, clearances and repair tolerances—additional items**

| Part and description | Dimension New | Permissible worn dimension for further use | Clearance New | Permissible worn clearance for re-use | Remarks |
|---|---|---|---|---|---|
| CARBON SEAL SEAT— OUTER FACE TO INTERNAL SHOULDER OF VAPOUR ASSISTER | 13·75 mm<br>13·35 mm (0·541 in.)<br>(0·527 in.) | 13·2 mm (0·519 in.) | — | — | Scored surface to be removed by lapping |
| METALLIC BELLOWS GLAND— WORKING LENGTH | 16·89 mm (0·665 in.) | 16·76 mm (0·660 in.) | — | — | Load 18 oz ± 2 oz at working length. Slight scoring can be removed by lapping |

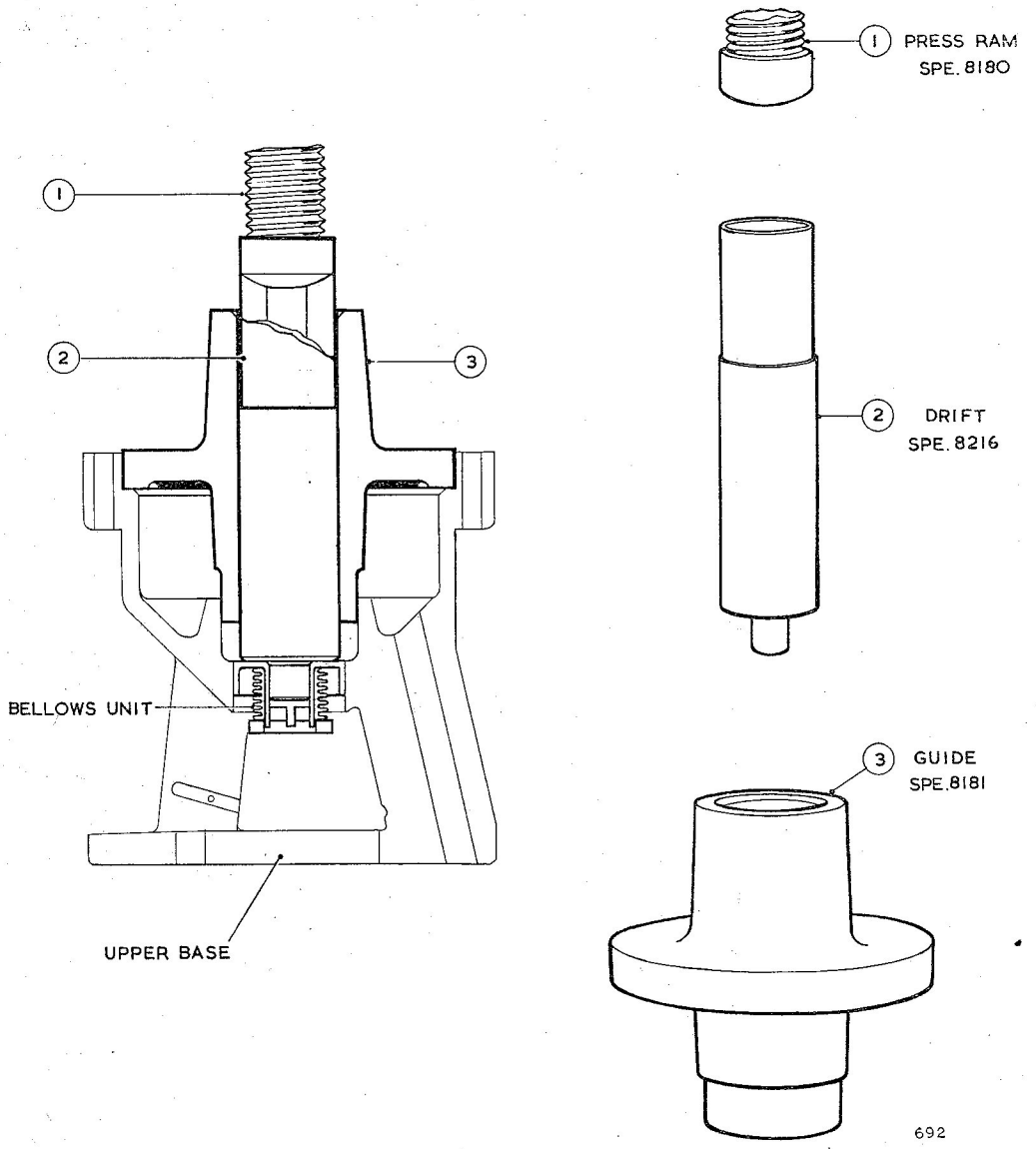


**Fig. 3. Removal of bellows gland**

(2) Run the motor unit on no load at not less than 20V d.c. for a minimum period of 3 hours, or until the brushes are bedded over their full width of arc, with at least 80% of their face area in contact with the commutator.

**Note . . .**

*The running time to achieve this condition may exceed 10 hours in some cases, dependent largely on the degree of accuracy of the brush pre-bedding.*

(3) At the conclusion of this run, while the motor unit is still warm, speed set the motor when subjected to an applied load as detailed in the Schedule of tests (para. 23-28).

(4) With the speed correctly set, securely tighten the screws (45) and apply a drop of approved air drying varnish to the end of each. Make sure that no varnish drops on to the commutator or any part of the brushgear.

(5) Mark each brush and positively

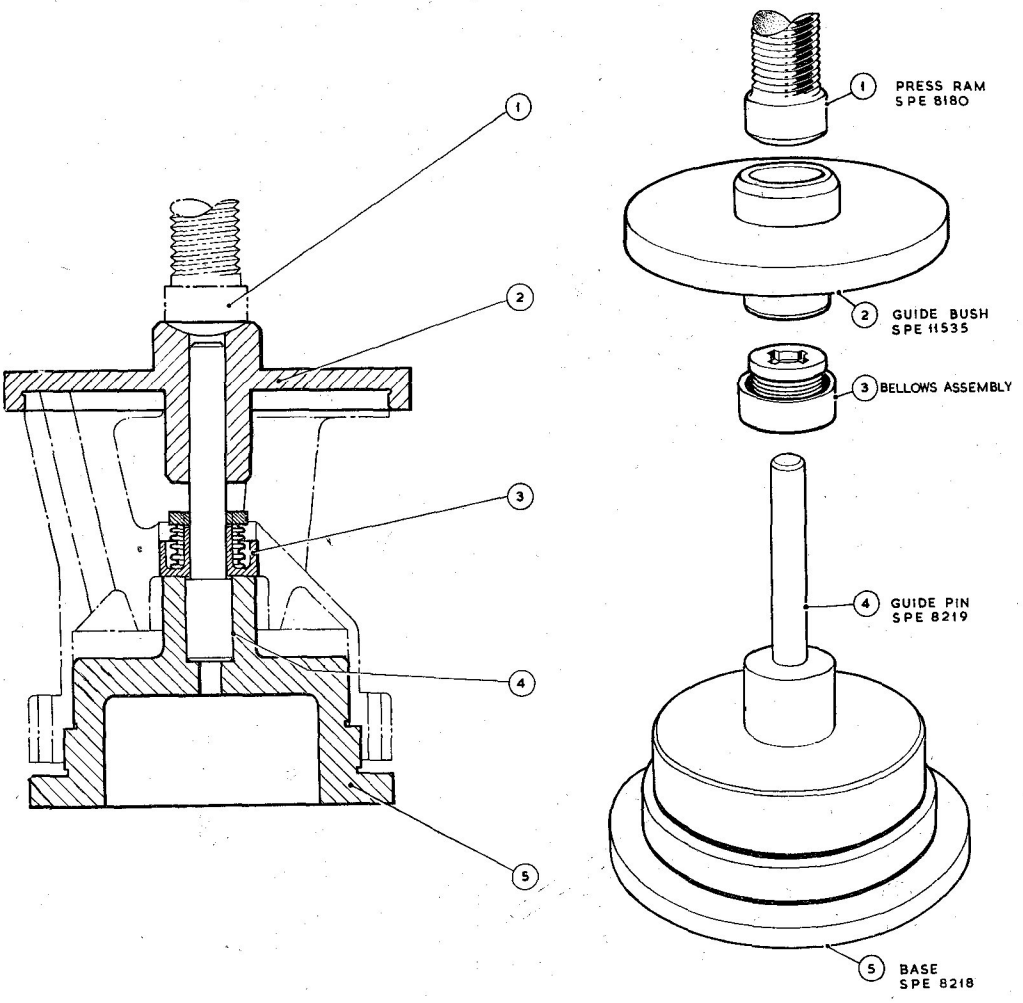


**Fig. 4. Replacement of bellows gland**

identify it with the box in which it is fitted. Remove the brushes, clean out all carbon dust with dry, compressed air, and replace the brushes in their original brush boxes. Re-connect the field coil leads and secure with screws (48) and shakeproof washer (49).

**Assembling the suppressor units (SPM.7/RS only)**

**13.** (1) Solder the earthing wire from the electric lead sub-assembly sheath (79) to a tag (78).

(2) Fasten each suppressor unit (56) to the mounting bracket (55) with two screws (53) and spring washers (54).

(3) Secure the mounting bracket to the end of the motor casing (77) with four cheesehead screws (51) and spring washers (52). Include the cable earthing wire tag (78) under the spring washer at one fixing position.

(4) Solder one electrical supply lead to an end tag of each suppressor unit (56) and a field coil lead to each of the other tags.

**Pump unit**

*Assembling the bellows gland*

**14.** (1) Ensure that all jointing compound has been removed from the bore of the upper pump base (85).

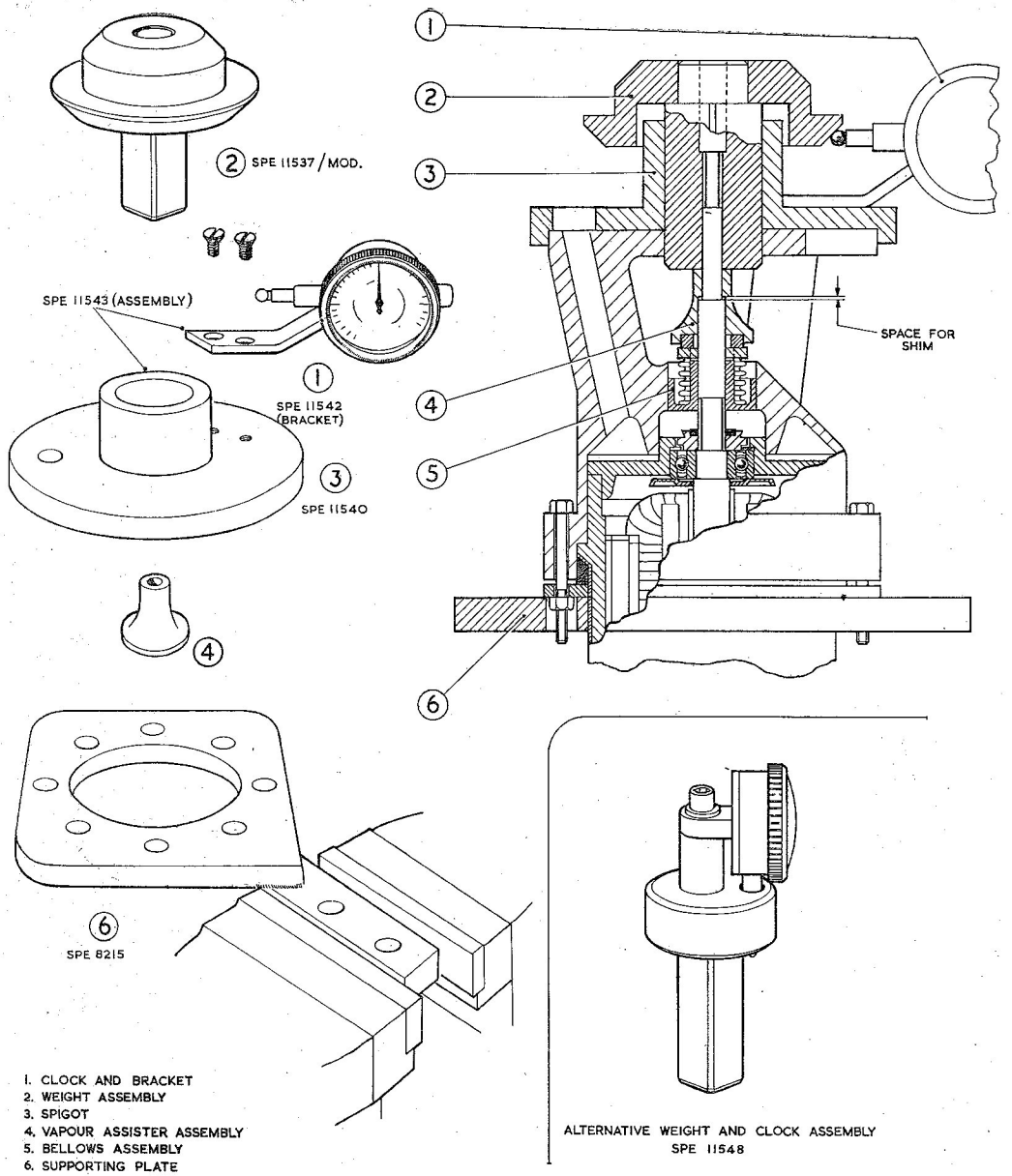


**Fig. 5. Checking loading of bellows gland**

(2) Pre-heat the casting to approximately 200 deg. F. (93 deg. C.).

(3) Smear the shroud of the bellows gland (80) with 'Wellseal' jointing compound, ensuring that none sets on to the gland seal face or convolutions.

(4) Use the special tools illustrated in fig. 4 to correctly position the gland in the pump casting.

*Assembling the motor to the upper base*

**15.** (1) Locate the motor unit on the dowel in the recess of the upper base, passing the electric lead assembly (79)—(SPM.7/RS only) down one of the three cored pillars.

(2) Fit the outer motor casing ((9)—SPM.7/RS: (9A)—SPM.7), a new joint ring (8) and the clamping bolt ring (7).

(3) Insert the six short bolts (4) and two long bolts (36) through the bolt ring and upper base. Note that the short bolts are inserted from the motor end of the pump. The long bolts, which must be assembled in diametrically opposite positions, are inserted from the bare end of the pump. *On Mk. 2 units only,* the long bolts (36) must be positioned so that when the filter (2) is assembled, the bush in the filter mesh is in line with the machined bonding bracket seating on the upper base flange.

(4) Secure the bolts with self-locking nuts (6:40). Tighten diametrically opposite nuts in turn by degrees to ensure even compression of the joint ring.

*Loading the bellows gland*

**16.** (1) Place the vapour assister assembly (82) in position on the motor spindle. Using the special tools illustrated in fig. 5, adjust the loading on the gland to 18 oz ± 2 oz by fitting shims (81) between the vapour assister and the shoulder of the spindle.

**Note . . .**

*These shims also act as a joint washer to prevent fuel creepage up the spindle.*

(2) Use the tooling as follows:

(a) Place the 18 oz weight (SPE 11537/Mod.) over the spindle and through the spigot SPE 11540. Locate on the vapour assister.

(b) Swing the clock gauge into position and register on a point close to the central hole through the weight. Set the gauge to zero reading.

(c) Fully depress the weight by finger pressure and note the new reading on the clock gauge. The difference between the two readings +0·010 in. to allow for shim compression on final assembly, gives the thickness of shim required for final fitting.

(d) Select shims (81) of the required total thickness. Lightly smear with an approved jointing compound and replace on the motor spindle together with the vapour assister assembly.

*Assembling the impeller*

**17.** Replace the shims (27), adjusting bush (83) and impeller (25), selecting shims and bushes of a thickness to correctly position the impeller (see Table 3, basic chapter). Fit and securely tighten the spindle nut (23).

**Pressure testing the assembly**

**18.** Generally as for the basic chapter but read 'bellows gland' for 'seal seat'.

**Assembling the lower base**

**19.** (1) Fit a blanking plate (24) in the lower base. Mk. 1 pumps which were found when dismantled to be fitted with a non-return valve, should have a blanking plate fitted in place of the valve on reassembly.

(2) Paint the contact surfaces of the upper and lower bases with 'Wellseal' jointing compound so that they are lightly covered all over. Place a new paper gasket (22) in position on the lower base studs and assemble to the upper base, threading the electrical lead assembly ((79) — SPM.7/RS only) through the electrical connecting mounting boss.

(3) *Mk. 2 units only:* Position a shakeproof washer and the bonding bracket in its seating on the lower flange of the upper base. Secure the base assemblies together with self-locking nuts.

**Note . . .**

*Early production models of the Mk. 2 pump do not include the bonding bracket unless incorporated by subsequent modification action. If the bushed filter assembly (2) is available, fit, the bonding bracket (42) to all rebuilt Mk. 2 pumps.*

(4) Solder the supply leads to the electrical connection (21) pins. Secure the connection to the lower base with round head screws and shakeproof washers.

(5) Where provision is made on Mk. 2 units for fitting the bonding strip (75), solder the tag (20) to the strip

and secure to the lower base tapping with a cheesehead screw and shakeproof washer.

(6) Fit the fireproof cover assembly (16) to the lower base with six cheesehead screws (13) and spring washers (12).

(7) Fit the drain plug (14) and its sealing washer (15). Wirelock the drain plug to the lower base with 22 S.W.G. locking wire to Spec. D.I.S.189 or D.I.S.161.

**Assembling the filter**

**20.** References in para. 38(1) of the basic chapter to the filter bonding bracket apply only to the Mk. 2 pump.

## TESTING

**General**

**21.** *SPM.7 Mk. 1 pumps only:* Mk. 1 pumps must be tested in accordance with the Schedule of tests detailed in this appendix.

*SPM.7 Mk. 2, SPM.7/RS Mk. 1 and Mk. 2 pumps only:* These pumps should be tested in accordance with the Schedule of tests detailed in para. 41-46 of the basic chapter.

**Test equipment**

**22.** The test rig illustrated in fig. 10 of the basic chapter can be used to test all the pumps covered by this appendix.

**Schedule of tests—SPM.7, Mk. 1 only**

**Note . . .**

*The tests must be carried out in the order detailed unless otherwise stated.*

*Torque test (motor unit only)*

**23.** The motor speed and current consumption at 24·0V d.c. must be observed and recorded when the motor unit is subjected to a torque of 26·0 oz in. applied by means of a calibrated fan or dynamometer. Motor speed must be within the limits 9150 ± 100 rev/min and current consumption must not exceed 12·0 amp.

*Insulation resistance test*

**24.** The insulation resistance must be measured before starting and after completing the tests detailed in para. 25-28 using a 250V insulation resistance tester. The insulation resistance should be not less than 0·5 megohm with the motor warm.

*Starting test*

**25.** With the pump fully primed and the delivery valve closed, the pump must start satisfactorily when a voltage of between 12 and 16V d.c. is applied for a maximum period of 3 seconds. Repeat 4 times. There must be no failure to start.

*Pressure test*

**26.** (1) With the pump stationary and fully primed under a 12 in. head of fluid, superimpose air pressure over the fuel at 10 lb/in² for 15 minutes. Observe for (a) leakage of fluid from the gland drain and (b) external fluid leakage. The maximum permissible leakage from the gland drain under these conditions is 1 drop per minute. External leakage is not permissible.

(2) Repeat the previous test with 28·8V d.c. applied to the motor unit for 5 minutes and with the delivery valve closed. The maximum permissible rate of leakage from the gland drain is 2 drops per minute. External leakage is not permissible.

*Proof and calibration tests*

**27.** With a 6 in. head of fluid over the pump inlet run the pump at each of the following conditions, with an interval of 5 minutes between each test run. Record the performance at the beginning and end of each test run and check for conformity with the figures given in Tables 4 or 5. Any appreciable change in pump performance other than that caused by the initial warming-up would reject the pump. Check that the no-flow delivery pressure of the pump at 28·8V d.c. does not exceed 41 lb/in² with a maximum current consumption of 12·5A.

*Dry test*

**28.** With the pump mounted clear of any fluid, run for 5 minutes only on an applied voltage of 28·8V d.c. Observe that the motor current during this test does not exceed 4A.

*Flushing run*

**Note . . .**

*The following details apply only if the pump has been tested using water/methanol mixture.*

**29.** Following the completion of the proof and calibration tests the pump is to be run under a 6 in. head of AVTUR fuel (Spec. D.E.R.D.2494) for 5 minutes only with the flow regulator set at 250 gal/hr and 26V d.c. applied.

**TABLE 4**

**Acceptance limits proof and calibration tests: Water/Methanol mixture**

| Test periods | Volts d.c. | Flow (gal/hr) | Delivery pressure lb/in$^2$ (min) | Current consumption Amp (max) |
|---|---|---|---|---|
| 4 runs of 5 min | 22·0 | 250 | 22·0 | 11·5 |
| 3 runs of 5 min | 24·0 | 250 | 25·0 | 12·0 |
| 2 runs of 5 min | 28·8 | 250 | 32·0 | 14·0 |

**TABLE 5**

**Acceptance limits proof and calibration tests AVTUR fuel**

| Test periods | Volts d.c. | Flow (gal/hr) | Delivery pressure lb/in$^2$ (min) | Current consumption Amp (max) |
|---|---|---|---|---|
| 4 runs of 5 mins | 22·0 | 250 | 19·8 | 10·35 |
| 3 runs of 5 mins | 24·0 | 250 | 22·8 | 10·9 |
| 2 runs of 5 mins | 28·8 | 250 | 28·9 | 12·9 |



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